NASA SCIENCE MISSION DIRECTORATE

Earth-Sun System Applied Sciences Program
Crosscutting Solutions Program Element
FY 2005-2009 Plan

Version 1.0

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Expanding and accelerating the realization of economic and societal benefits from Earth-Sun System science, information, and technology

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NASA Science Mission Directorate
Earth-Sun System Division
Applied Sciences Program

Applied Sciences for the Crosscutting Program Element

This document contains the Crosscutting Solutions Program Element Plan for Fiscal Years 2005-2009. This plan derives from direction established in the Earth Science Applications Plan, and the plan aligns with and serves the outcomes established in the NASA Integrated Budget and Performance Document.

The Program Manager and the Applied Sciences Program leadership have reviewed the plan, and they agree that the plan appropriately reflects the goals, objectives, and activities to serve the NASA Earth-Sun System Division and its Applied Sciences Program.

(Signature on file) February 18, 2005
Martin Frederick Date
Deputy Director, Applied Sciences Program
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NASA Earth-Sun System Division: Applied Sciences Program
Crosscutting Solutions

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I. Purpose and Scope of the Crosscutting Solutions Program Element

Context
The Crosscutting Solutions Program Element is part of NASA's Science Mission Directorate, Earth-Sun System Division's Applied Sciences Program. NASA's Science Mission Directorate, Earth-Sun System Division seeks: to increase knowledge of the Earth-Sun system, including its response to natural and human-induced changes, and to enable improved predictions of climate, weather, and natural hazards.

Purpose of the Applied Sciences Program Crosscutting Solutions Program Element
The Applied Sciences Program extends the results of NASA Earth-Sun system science research and knowledge beyond the science and research communities to contribute to national priority applications with societal benefits. The Applied Sciences Program employs a systems engineering approach, develops partnerships with operational federal agencies and national organizations, and facilitates the transition from research to operations to accomplish this goal. The Program identifies integrated system configurations that can benefit from the assimilation of science research results into decision support tools, therefore achieving sustainable solutions for the nation and world. The Program benefits citizens through contributions to federal partners with connections to state, local, and tribal governments. The Applied Sciences Program consists of two Program Elements:

- National Applications Program Element - focuses on the "demand side" of the Applied Sciences Program architecture (Figure 1) through partnerships with operational agencies to infuse Earth-Sun system research results into specific decision support systems (DSS) in twelve areas of national priority.
- Crosscutting Solutions Program Element - focuses on the "supply side" of the architecture (Figure 1) through engineering activities to integrate sub-systems into system solutions supporting the twelve National Applications. These activities are enabled by a comprehensive, evolving knowledge base of NASA science research results, networks of contributing organizations, and highly-skilled, specially-trained human capital.

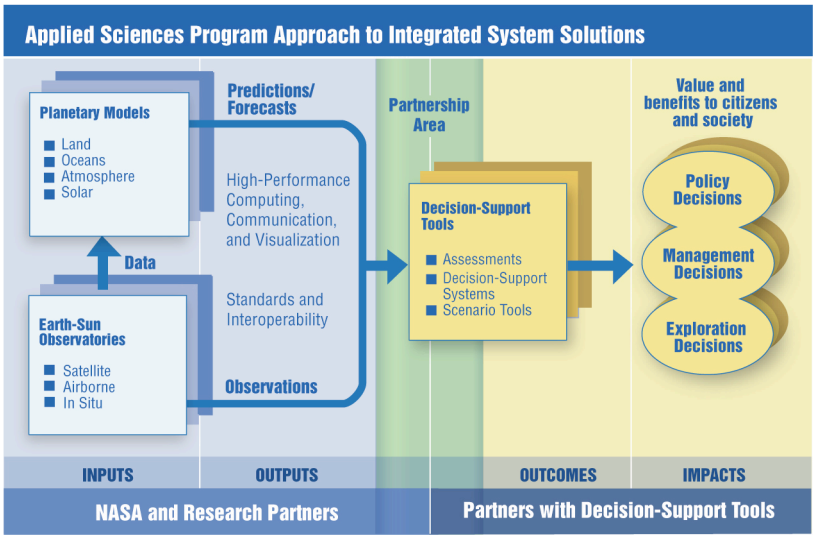

Figure 1: Applied Sciences Program Approach to Integrated System Solutions

Relationship Between Program Element and Other Entities
The Crosscutting Solutions Program Element is an integral part of a complex network of entities contributing to the goals of NASA and other federal agencies.

Internal to the Applied Sciences Program, Crosscutting Solutions is closely coupled to National Applications. It is also closely coupled to the other programs in the Earth-Sun System Division: the Research and Analysis, Flight Missions, Data and Information Management, Technology, Sub-Orbital Science, Education, and Outreach Programs.

The primary resource base for Crosscutting Solutions is NASA Earth-Sun system research results. This is derived from the results of Earth-Sun System Division investments contributed by funded researchers through competitive solicitations. The Research and Analysis Program is the primary administrator the investment portfolio. The Research and Analysis Program; NASA Field Centers; partner Earth-Sun system science laboratories; and other NASA-funded entities from government, academia, and industry provide Earth-Sun system models, observations and information products derived from remote sensing instrumentation deployed on NASA Earth-Sun system observation spacecrafts, sub-orbital platforms and ground-based networks, and the data products managed in the Earth-Sun system science information systems (such as the Distributed Active Archive Centers (DAACs)).

The systems engineering approach employed by Crosscutting Solutions requires an intimate familiarity with the past, present, and planned outputs from these entities; a capability to understand the practical applications of the outputs to national and international priorities, and an ability to build working partnerships and cooperative relationships to optimize the use of the entities' outputs as potential inputs for decision support.

Scope of the Program Element

The primary focus of the activities in the Crosscutting Solutions Program Element is to extend the benefits of results from NASA-sponsored Earth-Sun system science research and development for societal benefit. This is accomplished through the development or enhancement of systems, knowledge bases, networks, integrated system solutions (ISS), and human capital necessary to enable the Applied Sciences Program to achieve its objectives.

The Program Element has four subordinate functions. These functions are:

- Integrated Benchmarked Systems (IBS)
- Solutions Networks (SN)
- Geoscience Standards and Interoperability (GSI)
- Human Capital Development (HCD)

In addition, the Program has six specific areas of focus for FY05. These will be be conducted within the scope of the four functions. The areas of focus are:

- Internal - Supporting NASA's Exploration Initiative
- Internal - Supporting the Transition of NASA Research Results to Operations
- Internal - Integrating Solar Observations/Models into Applied Sciences Activities
- External - Contributing to National and International Priorities
- External - Exploiting the Earth-Sun System Models for Decision Support
- External - Optimizing Performance for the Networks of Funded Organizations

Purpose for this plan
The purpose of this document is to:

- Articulate the scope and purpose of the Crosscutting Solutions Program Element
- Describe the strategy for meeting the objectives of this Program Element
- Serve as a Program Element management tool
- Link Program Element activities to higher level performance metrics (documented in the NASA Integrated Budget and Performance Document (IBPD) Program Assessment Rating Tool (PART))
- Communicate Program Element implementation strategies to stakeholders

The Crosscutting Solutions Program Element Plan covers a five-year period and is updated every year. The Plan documents the detailed planning for all the Sub-Elements for the current year and projected activities for the future years. This document covers the plan from Fiscal Year (FY) 2005 through FY09.

Note: The Applied Sciences Program heritage is from the former NASA Earth Science Enterprise Applications Theme and the Space Science Enterprise Earth-Sun Connection Theme. During the transition year of FY05, the Program's budget structure is still tied to the heritage theme approach. This transition artifact will be noted where clarification may be necessary in this document.

II. Goals and Objectives

The goal of the Crosscutting Solutions Program Element is to support NASA, the Science Mission Directorate, and specifically the Earth-Sun System Division Applied Sciences Program. The two principle objectives are:

- Establish partnerships and infrastructure that provide systems engineering support and enable integrated system solutions that evaluate, verify and validate, and benchmark Earth-Sun system research results.
- Support NASA contributions to national and international programs with systems engineering and applied science research that leads to scalable, systematic, and sustainable solutions and processes using NASA research results. This will facilitate establishing the basis for effective transition from research to operations. The programs include, but are not limited to: Climate Change Science Program (CCSP), Climate Change Technology Program (CCTP), Intergovernmental Panel on Climate Change (IPCC), United States Weather Research Program (USWRP), World Meteorological Organization (WMO), Earthscope, Committee on Environment and Natural Resources Subcommittee on Disaster Reduction (CENR/SDR), Interagency Working Group on Earth Observations (IWGEO), *ad hoc* Group on Earth Observations (GEO), National Academy of Sciences (NAS), World Summit on Sustainable Development (WSSD), and Commercial Remote Sensing Space Policy (CRSSP).

Program direction is guided by the NASA Strategic Plan, Earth Science Strategy, and science research activities (e.g. Observing System Simulation Experiments (OSSEs), Project Columbia, the Joint Center for Satellite Data Assimilation (JCSDA), the Earth-Sun Gateway (ESG), and the Transition from Research to Operations activities (R2O)). The Program also promotes use of, or contributions to, initiatives such as the Global Information Grid (GIG); Federal Enterprise Architecture (FEA); State Enterprise Architecture (SEA); the national laboratories; and international commitments that influence the design, direction, and activities of the Program.

The FY05 President's Budget for the NASA Applied Sciences Program specifies $54M annually for FY05-FY09 for the National Applications (approximately $24M) and Crosscutting Solutions (approximately $30M) activities. While directly managing a subset of the ~$24M budget, each National

Application activity benefits from the annual ~$30M in Crosscutting Solutions. Each National Application activity also leverages and extends research results from the accumulation of $2.3B per year invested in supporting Earth-Sun system science.

III. Program Management and Partners

Program Management Structure

The NASA Applied Sciences Program in the Earth-Sun System Division of the Science Mission Directorate at NASA Headquarters (HQ) is the program office responsible for administering the Crosscutting Solutions Program Element.

Figure 2 illustrates the overall structure of the Crosscutting Solutions Program Element, its Sub-Elements and projects within each Sub-Element for FY05. It also demonstrates how this Program Element fits within the overall structure of the Applied Sciences Program.

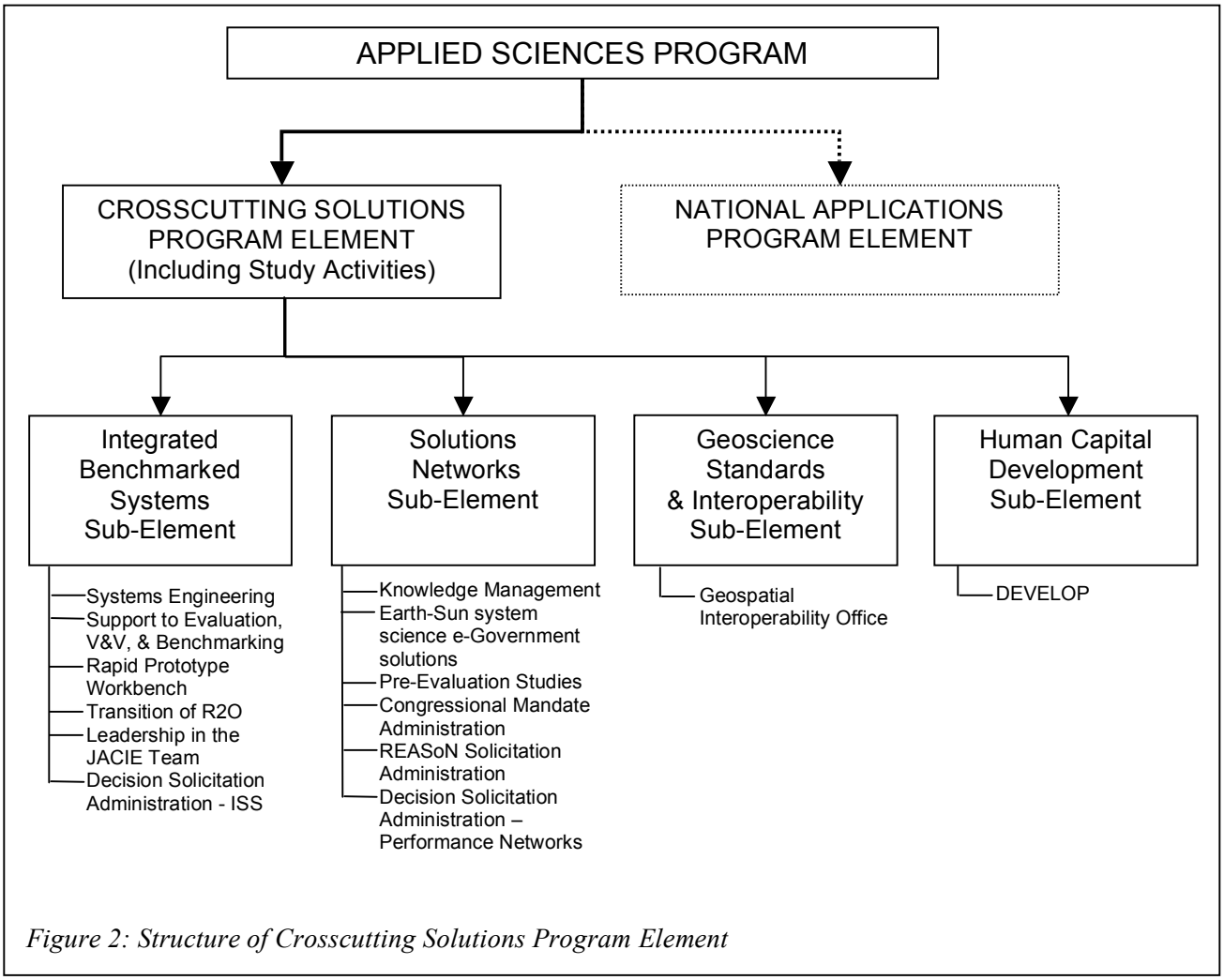

Figure 2: Structure of Crosscutting Solutions Program Element

The primary focus of activity within the Sub-Elements is described below:

Table 1: Crosscutting Solutions Sub-Elements

FUNCTION	PRIMARY ACTIVITY
Integrated Benchmark Systems	Provide systems engineering support for the evaluation, verification and validation, and benchmarking of NASA observations and predictions for use in decision support systems and tools for the integrated system solutions configurations associated with the National Applications Program Elements
Solutions Networks	Establish and maintain relationships with Earth-Sun system science research organizations and maintain a knowledge base of activities, capabilities, plans, and results for tactical and strategic support to the Applied Sciences Program
Geoscience Standards and Interoperability	Facilitate development of, and enable Program compliance with, national and international standards and interoperability protocols for the exchange of data and information produced by federal agencies
Human Capital Development	Develop a cadre of human resources possessing real world experience associated with integrated system solutions by creating rapid prototype solutions using Earth-Sun system science research results as inputs to decision support systems for federal, state, local, and tribal applications consistent with the National Applications

Program Performance

The Program recognizes that certain functions are inherently governmental, and there is a need to maintain specific core capabilities. Therefore, each of the Sub-Elements is managed at a NASA Field Center (For FY05, IBS and SN are managed at Stennis Space Center, GSI is managed at Goddard Space Flight Center, and HCD is managed at Langley Research Center). Whenever possible, the Crosscutting Solutions Program Element applies competitive sourcing to optimize the quality and caliber of the products and services provided by selected organizations; and to maintain an appropriate balance of sustainable capacity for NASA program administration.

General performance expectations for each Program Sub-Element are: contribution to the goals and objectives of the Program, rigorous management of resources to realize optimal performance for the authorized budget, and regular progress/issue reporting. The methods employed to meet these performance expectations depend on the type of activity within the Sub-Element and are documented in the respective Sub-Element project plans. Sub-Element activities are required to develop project plans that include: project objectives, team members, work breakdown structure, budget, schedule, deliverables, and metrics. The approval hierarchy for the project plans consists of the Sub-Element Project Manager, NASA Field Center senior Earth-Sun system science manager, and the Crosscutting Solutions Program Element Management at NASA HQ.

The primary methods for achieving performance include:

- **Competitive Solicitations:** Solicitations are developed to facilitate opportunities for universities, government organizations, not-for-profit organizations, private sector organizations, and NASA Centers to submit proposals for peer review. The procurement may encompass cooperative agreements, contracts, and grants. Solicited projects require project managers and project plans.
- **Systems Engineering:** NASA expertise at NASA Field Centers is employed to conduct systems engineering that transfers research results to partner organizations efficiently and effectively through integrated system solutions. Other targeted projects have benefits that cut across all National Applications and may be applied to one or more of the integrated system solutions configurations, to transfer research to operations, and/or to enable operational capacity to contribute to NASA's Earth-Sun system science research agenda. Each integrated system solution or targeted project requires project managers and project plans associated with one or more of the national applications.
- **Congressionally mandated activities:** NASA receives congressional direction to pursue specific activities whose administration is assigned to the Applied Sciences. NASA program and project managers work with principal investigators representing congressionally directed projects to align activities with the Applied Sciences Program goals and objectives. The Applications teams include these organizations in existing networks and collaborate with them, as appropriate, in contributing to integrated benchmark solutions with partner agencies.

Sub-Element Management

The Crosscutting Solutions Program Manager, together with the management at the Field Centers, is responsible for designating Sub-Element Project Managers for each Sub-Element. Sub-Element Managers are responsible for:

- Developing and nurturing relationships with current and potential partner organizations that contribute to Crosscutting Solutions goals and objectives through regular communication, meetings, workshops, and other appropriate means
- Identifying and maintaining a network of organizations and contacts for activities associated with Crosscutting Solutions goals and objectives and pursuing formal agreements, as appropriate, with partner organizations
- Developing and executing Sub-Element project plans
- Ensuring that all activities and functions within Sub-Elements are executed efficiently and within cost and schedule targets allocated and administered by the Crosscutting Solutions Program Manager
- Coordinating the transfer and management of funds allocated to NASA Centers from the Program Office at HQ to appropriate Centers if more than one Center is involved with a Sub-Element
- Managing ISS activities associated with competitively selected proposals through solicitations such as the Decisions Solicitation.

Program Management Principles

The Crosscutting Solutions Program Element Management and its Sub-Element teams conduct the Program according to the following guidelines and principles:

<u>One NASA</u>

The Program management and members of each team work collaboratively to efficiently achieve the goals of the entire Applied Sciences Program. Teamwork is emphasized amongst and between Centers, with all appropriate aspects of NASA and the Earth-Sun System Division, and with the partner organizations.

Partner Focus

The Element teams focus on interagency, intergovernmental, and community-of-practice partner organizations and recognize the partner organizations' participation in extending the benefits of Earth-Sun system science results. In most cases, partners bear the responsibility for policy and management decisions. The partners are potentially changing their systems to accommodate Earth-Sun system science observations and products. Therefore, teams need to maintain focus on the partners, and direct attention and recognition toward them for the improvements in decision-making. If the NASA-led teams are cognizant of data products and/or models from non-NASA sources that may be beneficial to partners, this information will be shared.

Balance Between Competitive Sourcing and Directed Projects

The Office of Management and Budget (OMB) requirement in the IBPD is for at least eighty percent of the Program budget to be used in activities that have been peer reviewed and competitively sourced. The Program embraces the use of competitive sourcing techniques as a tool for increasing efficiency, cost-effectiveness, and innovation in the Program and maximizing the overall capacity of the nation to perform this work. Directed funding to projects will only be used when competitive sourcing techniques cannot meet the requirements for the activity. For example, directed funding to NASA Centers is necessary to perform many required inherently governmental functions.

NASA Headquarters - A Node, Not The Hub

The Sub-Element teams may work with limited daily guidance from the Crosscutting Solutions Program Element Manager. The teams are expected to take initiative to understand and accomplish the Program goals. The Program Manager and teams keep each other informed about progress, schedule changes, issues, and opportunities in order to assist each other to accomplish the goals and objectives. The Program, Sub-Element, and project Managers establish connections and appropriate agency-to-agency agreements to enable the teams' direct working relationships with the partner organizations and representatives.

Set and Meet Project Goals

The Program Manager and teams set challenging and realistic goals, schedules, and deliverable items in project plans. The Managers develop plans, goals, and schedules in a collaborative environment with the team. In case of differences within the team on programmatic plans, the Program Manager has the responsibility to facilitate and finalize decisions.

Share Information

The Program Manager and teams share information and inform the entire Applied Sciences Program of successful operating procedures, lessons learned, pitfalls, beneficial activities, or other relevant information in order to assist all participants in the community-of-practice.

Innovation and Leadership

The teams have the latitude to experiment, innovate, take initiative, and try different approaches in developing mechanisms to meet objectives. As appropriate, teams may pursue several techniques in parallel to identify effective methods, which will extend NASA Earth-Sun System science results to partners' decision making.

Working with Partners' DSSs

While NASA helps develop prototypes and guidelines as part of the benchmarking process, NASA and the Applied Sciences funded entities will not engage in direct interaction with a partner's customers or in the independent development of any DSS for the partner. NASA may consider, on a case-by-case basis as approved by the Program leadership, contributing in a supporting role to enhance a DSS under development in a partner-led effort.

Exit Strategies

In developing projects with partners, the Element teams anticipate and articulate expectations related to disengaging and terminating NASA involvement as activities extend beyond NASA's authorized role. In addition, the determination, positive or negative, that Earth-Sun System Division research results or products have value to a partner's decision tool, or subset of the tool, is the primary objective of an activity. A negative determination is not a failure; rather, it allows a clear answer and permits the team to focus energy and resources in proper directions.

Program Element Roles and Responsibilities

The roles and responsibilities of the contributors to the Crosscutting Program Element are given below:

NASA Field Centers

The NASA Field Centers supporting the Earth-Sun System Division include Ames Research Center (ARC), Dryden Flight Research Center (DFRC), Goddard Space Flight Center (GSFC), Langley Research Center (LaRC), Marshall Space Flight Center (MSFC), Stennis Space Center (SSC), and the NASA-affiliated Jet Propulsion Laboratory (JPL). NASA Centers have unique capabilities and expertise related to Earth-Sun system science, research, technology, systems engineering, project management, and technology transfer, all of which contribute to Crosscutting Solutions. Program Elements support and utilize strengths and expertise from the appropriate Centers to serve the Earth-Sun System Division and Applied Sciences Program objectives. NASA Centers are expected to contribute, compete, coordinate, and collaborate as appropriate for the overall success of the Crosscutting Solutions Program Element.

NASA Headquarters

NASA HQ serves as the program office and contributes overall administration and management for the Crosscutting Solutions Program Element. The Program Manager establishes Program direction consistent with the Applied Sciences Program, Earth-Sun System Division, Science Mission Directorate, NASA, and administration priorities, goals, and objectives. In addition, the Program Manager addresses team issues, raises concerns to Earth-Sun System Division management, and interacts with partners at programmatic levels as needed. Overall, the Program Manager advocates and champions the Program Elements internal and external to NASA.

NASA Partners

Partners and stakeholders include interagency and intergovernmental collaborations through the CCSP, CCTP, IPCC, USWRP, WMO, Solid Earth Science Working Group (SESWG), Earthscope, IWGEO, GEO, WSSD, and CRSSP. Program partners also include Space Act Agreements with commercial remote sensing providers such as DigitalGlobe, Space Imaging, Orbview, and EarthSat Corporation.

The NASA Applied Sciences Program strategic approach, Program Elements and projects have been introduced, reviewed, and integrated into the following national and international programs that embrace NASA's participation in integrated system solutions:

- CCSP (www.climatescience.gov)
- CCTP (www.climatetechnology.gov)
- Committee on Environmental and Natural Resources (CENR) Interagency Working Group on Earth Observations (http://iwgeo.ssc.nasa.gov)
- U.S. Weather Research Program (www.oar.noaa.gov/organization/uswrp.html)
- CENR Subcommittee on Disaster Reduction (www.sdr.gov)
- CRSSP implementation (http://crsp.usgs.gov)
- President's Initiative Against Illegal Logging (www.whitehouse.gov/infocus/illegal-logging/)
- National Academy of Sciences Roundtable for Sustainability (www.nas.edu)

The Program is collaborating with the IPCC (www.ipcc.int), WMO (www.wmo.int), GEO (http://earthobservations.org/), and WSSD (http://www.iied.org/wssd).

Project Management
The Crosscutting Solutions Sub-Elements provide status reports to the Program Manager according to the frequency specified in the individual Sub-Element project plans. The reports will include, but are not limited to:

- Status of activities and accomplishments toward stated and unplanned objectives
- Schedule
- Budget and spending plan
- Deliverables and accomplishments
- Important issues and risks

In addition, the Applied Sciences Program periodically holds Program reviews where Sub-Elements describe activities relative to the Program objectives.

Program Element Linkage to Associations and Publications
Associations and publications, which link to the Crosscutting Program Element, are given below:

Associations and Conferences
The primary associations and conferences for the Crosscutting Solutions Program Element include, but are not limited to:

- American Meteorological Society (AMS)
- American Geophysical Union (AGU)
- International Symposium on Remote Sensing of Environment (ISPRS)
- International Remote Sensing for the Environment (IRSE)
- International Geoscience and Remote Sensing Symposium (IGARSS)

Publications
The primary publications for conveying plans and results of the Program Element include, but are not limited to:

Trade Journals
- *Earth Observation Magazine*
- *Earth Imaging Journal*
- *Weather*

Peer Review Journals
- *IEEE Computing in Science and Engineering*
- *IEEE Systems Engineering (check on specifics)*
- *PERS – Photogrammetric Engineering and Remote Sensing*
- *Remote Sensing for the Environment*

IV. Crosscutting Solutions Activities

Context for Activities
The Crosscutting Solutions Program Element contains a portfolio of tactical and strategic activities to accomplish Program objectives and to prepare for future challenges of the Earth-Sun System Division and Applied Sciences Program.

Tactical Activities
Crosscutting Solutions provides support for the following activities undertaken for each of the National Applications Program Element projects. Each project activity proceeds through one or all of the following steps depending on maturity at the time of selection:

- Evaluation – Identify DSS, developed by federal agencies and other partners, that are a national priority and can be enhanced by NASA Earth-Sun System Division research results. Develop the specifications for how candidate DSS can be augmented by assimilating NASA Earth-Sun System Division observations and predictions
- Verification – A life cycle process to ensure Earth-Sun system science products being developed meet stated specifications (function, performance, and design) within the context of an identified integrated system solution configuration
- Validation – A process to ensure completed products (software, algorithms, models) effectively serve the functional requirements of an integrated system solution configuration
- Benchmark – A standard by which a product can be measured or judged (e.g. the measure of DSS performance with assimilated NASA measurements), in terms of operations and functions, with respect to performance without the NASA results. The benchmarking process is required to support adoption of innovative solutions into operational environments that affect life and property

Tactical activities within the Crosscutting Solutions Program Element consist of providing systems engineering support in conducting these processes for the Sub-Elements for each integrated system solution administered through the Applied Sciences Program. The Program benefits from NASA systems engineering capacity, including the OSSE capacity at GSFC, the Independent Verification and Validation (IV&V) capacity in West Virginia, the data handling capacity in each of the DAACs, and the science capacity at Centers and Earth-Sun system science laboratories.

Strategic Activities
The net result of all activities is to serve applications of national priority and to make contributions to NASA's strategic commitments to CCSP, CCTP, IPCC, USWRP, WMO, IWGEO, GEO, WSSD, and CRSSP.

Strategic activities within the Crosscutting Solutions Program Element support development of:

- Systems engineering resources and infrastructure
- Knowledge bases
- Networks of organizations and experts
- Next generation of contributors to the Program

This is done to facilitate effective achievement of the Applied Sciences Program goals and objectives. To this end, activities within this Program Element include:

- Establishing global standards and interoperability protocols for system and data interfaces

- Developing niche-oriented human capital focused on interdisciplinary systems engineering, which facilitates the evolution of networks to enable distributed organizations to effectively contribute to solutions whose total capacity is greater than the sum of its parts

The desired impact for the resulting networks, standards, prototypes, processes, guidelines, integrated system solutions, human capital, and outreach is for communities of practice and their beneficiaries to optimize the net gain from the nation's investment in NASA Earth-Sun system science research. This is accomplished through the systematic transition of research results to serve society through operational use of space-based observations and predictions in decision-making processes for applications of national priority.

The Program has strategic connections with national e-Government activities including the:

- Federal Enterprise Architecture (FEA)
- Federal Geographic Data Committee (FGDC)
- Geospatial One Stop (GOS)
- OpenGIS Consortium (OGC)

The Program has strategic connections with national, Agency, Directorate, and Division technology and infrastructure development, including:

- High-end computing initiatives (e.g. Project Columbia)
- Data management initiatives associated with Global Climate Observing System (GCOS), Global Terrestrial Observing System (GTOS), Global Ocean Observing System (GOOS), Earth Observing System Data Information System (EOSDIS)
- Graphic Retrieval and Information Display (GRID) initiatives including the Lambda Rail
- Data portal and web service projects including the National Science Foundation (NSF) cyber infrastructure program
- Earth-Sun Gateway (ESG)
- Modeling initiatives including the Earth System Modeling Framework (ESMF) and Sun-Solar System Modeling Framework (SSMF)

Crosscutting Solutions Sub-Elements and Projects

A. FY05 Funded Activities

1. Integrated Benchmark Systems Sub-Element

The IBS Sub-Element is primarily implemented through the Applied Science Directorate located at Stennis Space Center. IBS Sub-Element activities are designed to:

- Provide systems engineering support for the evaluation, verification and validation (V&V), and benchmarking of NASA observations and predictions for use in decision support systems and tools for the integrated system solution configurations associated with the National Applications Program Elements
- Collaborate with NASA instrument calibration and verification teams and science teams responsible for verifying and validating the approximately 2500 Earth-Sun system science observation products developed and delivered through the EOSDIS, along with all other NASA funded projects generating research results, including the Earth Science Information

Partnership (ESIP); Research, Education, and Applications Solutions Network (REASoN); and data assimilation capacities provided by the JCSDA

- Perform characterization/V&V of commercial sources of remote sensing observations for Earth-Sun system science research through participation in the Joint Agency Commercial Imagery Evaluation (JACIE) team

The implementation of the IBS Sub-Element is divided into the five projects listed below

- Systems Engineering Support to Evaluation, V&V, and Benchmarking
- Rapid Prototyping Workbench
- Transition of Research Results to Operational Utilization
- Leadership in the Joint Agency Committee for Imagery Evaluation Team
- Decision Solicitation Administration – Integrated System Solutions

a. Systems Engineering Support to Evaluation, V&V, and Benchmarking

This activity provides systems engineering support to the evaluation, V&V, and benchmarking activities for each of the integrated system solutions configurations associated with the National Applications Program Elements. Systems engineering activities include, but are not limited to:

- Evaluation of decision support tool (DST) input requirements
- Identification of NASA measurements and model outputs to serve DST input requirements
- Assessment and assimilation of NASA outputs as inputs to DSTs, V&V of NASA observations and predictions within the context of DST performance
- Participation with partnering organizations in benchmarking the operational performance of DSTs with integrated NASA research results

Specific systems engineering requirements and activities are defined through National Applications Program Plans and/or direct interaction with the National Applications Program Managers and the Crosscutting Solutions Program Manager.

Systems engineering activities draw heavily on the work performed in establishing, evolving, and maintaining the Knowledge Management Project Element within the Solutions Networks Program Sub-Element. The Sub-Element systematically catalogues the available NASA Earth-Sun system observation missions, instruments, measurements, models, predictions, and research that can be assimilated into partner decision support tools through integrated system solutions.

b. Rapid Prototyping Workbench

A goal of the Crosscutting Solutions Program Element is to dramatically reduce the time required to evaluate candidate integrated system solutions for the National Applications while improving the quality of the evaluations. To this end, the IBS sub-element will be conducting studies for alternative approaches for, and ultimately investments in, the development of tools and systems to centrally connect NASA Earth-Sun System research results from a myriad of sources with the National Applications partners' DSSs. The concept for using these tools and systems together to meet the Program goals is called a Rapid Prototyping Workbench.

c. Transition of Research Results to Operational Utilization (R2O)

The Executive Branch of the federal government recognizes the value in processes and systems that optimize the transition of research and development results for operational utilization. NASA, NOAA and other federal agencies working together and under the auspices of national activities such as the Interagency Working Group on Earth Observations (IWGEO) are studying and will ultimately invest in the planning and transition of physical, information and knowledge assets. NASA and NOAA have initiated an effort using e-government tools (such as the FEA and database driven knowledge management systems using tools like Metis) to identify candidate configurations between current and future NASA research results and NOAA operational requirements that can be evaluated for adaptation or adoption in meeting operational requirements. The expectation is that other operational agencies, such as USDA, will eventually participate in the efforts to investigate and plan transitions.

d. Leadership in the JACIE Team

Through the JACIE team, NASA participates with the National Geospatial Intelligence Agency (NGA) and the United States Geological Survey (USGS) in collaborative interagency approaches for characterization of commercial remote sensing products for government and Earth-Sun system science research community use. As part of this effort, NASA leads the JACIE team by coordinating with NGA and USGS to leverage characterization expertise and by interacting with industry to communicate and share calibration and characterization results. NASA forms partnerships with experts in academia, including the University of Arizona and South Dakota State University to perform thorough characterizations of commercially provided, aerospace-derived remote sensing data products. JACIE characterization results and related activities are communicated to the science community through face-to-face meetings, an annual JACIE workshop, NASA Technical Memos, and peer-reviewed publications.

Recognizing that commercial remote sensing systems have the capacity to serve a portion of science research measurement needs, a systematic study of NASA's Earth-Sun system science requirements for commercial data/products, specifically with respect to land use and land cover observations for carbon cycle and water cycle research, was performed in FY04. Based on the results of this study, purchase and characterization of such data/products will be implemented in FY05. Data requirements and JACIE-related activities manifest NASA's contribution to the implementation of the Administration's Commercial Remote Sensing Space Policy.

e. Decisions Solicitation Administration – Integrated System Solutions

The Decisions Solicitation run by the Applied Sciences Program will fund projects to produce Integrated System Solutions for the National Applications Program Elements. The IBS team at NASA Stennis Space Center, in coordination with the Applied Sciences Program management, will manage the administration of projects selected under this solicitation.

The "Decision Support Through Earth Science Results" Solicitation (NN-H-04-Z-YO-010-C) was released on September 17, 2004. The solicitation contained two major components: (A) Integrated System Solutions for Applications of National Priority, and (B) Performance Networks for Earth Science Solutions. The IBS Sub-Element will manage awards resulting from successful proposals to section A of the solicitation.

The Integrated System Solutions component of the NASA Research Announcement (NRA) focuses on extending NASA Earth-Sun system research results to decision support tools in the twelve Applications of National Priority. The direction of each application is captured in roadmaps and integrated system solutions configurations described in the NASA Earth Science Applications Plan, accessible at http://www.earth.nasa.gov/visions. The roadmaps and configuration diagrams are accessible at http://www.earth.nasa.gov/roadmaps.

Through the Integrated System Solutions portion of this solicitation, the Program supports results-oriented projects focused on systematic methods to enable the integration of Earth-Sun system science research results (e.g., spacecraft observations, model predictions, and visualization techniques) into existing decision support tools related to one or more of the twelve Applications of National Priority.

2. Solutions Networks Sub-Element

The SN Sub-Element is primarily implemented through the Applied Sciences Directorate located at Stennis Space Center.

The Solutions Networks Sub-Element focuses on establishing and maintaining relationships with Earth-Sun system science research organizations and maintaining a knowledge base of activities, capabilities, plans, and results for tactical and strategic support to the Applied Sciences Program.

The Solutions Network is a systems approach of the Applied Sciences Program theme to enable holistic solutions for societal benefits to be greater than the sum of the parts administered by the Earth-Sun System science theme. During the past five years, the former Earth Science Enterprise administered an average of approximately 2000 individual funded projects. These projects included approximately 1500 research grants, 100 Earth observation technology and systems projects, 200 education grants, and 200 Applied Sciences Program grants. The challenge in achieving the goals and objectives of the Agency, Directorate, and Division—in order to deliver results that reflect the mission "to understand and protect the home planet"—is the need to assimilate and integrate the results of distributed science and technology research and development into focused solutions that are targeted at specific societal benefits.

The Solutions Network Sub-Element is focused on addressing this challenge by systematically establishing a network of organizations involved in the Earth-Sun System Division and coordinating activities to optimize the net performance of contributing organizations in the network.

Specific goals of the Solutions Network are to:

- Develop a detailed understanding and knowledge base of Earth-Sun System Division mission observations and model predictions and their respective ability to be assimilated into decision support tools. The resource base includes all observations from current and planned Earth-Sun system observatories resulting from NASA research and development.
- Establish and maintain a network of national and international organizations involved in integrated system solution activities to support improved decision-making. Representative programs include: CCSP, CCTP, IPCC, USWRP, WMO, Earthscope, SESWG, IWGEO, GEO, FGDC, GOS, NSF, Cyberinfrastructure, WSSD, ESMF, High -end computing initiatives, Grid Computing, Web Services, Commercial Remote Sensing Policy (CRSP)

Implementation Working Group, International Society of Photogrammetry and Remote Sensing (ISPRS), and the Committee of Earth Observing States (CEOS)

- Leverage the existing portfolio of funded Earth-Sun System Division investments and partnerships to optimize the incorporation of relevant and innovative results into integrated system solution configurations that contribute to the Earth-Sun System Division goals and objectives
- Coordinate and optimize the interaction of organizations contributing science and technology to NASA and the Earth-Sun System Division, through a networked configuration that contributes to the goals and objectives of the Earth Science Application Plan
- Provide human capital and infrastructure to support National Applications Program Managers, IBS Systems Engineering teams, Earth-Sun System Division entities, applications communities, and partners
- Administer grants and cooperative agreements selected through competitive sourcing opportunities administered by the Program Office at NASA HQ
- Administer grants for congressionally directed projects

To achieve these goals with minimal stress on existing budget resources, appropriate communication mechanisms (e.g. targeted documentation, web portals, forums, network agents) are implemented. These will enable the Solutions Network to contribute to the NASA Applied Sciences Program paradigm, and to enable pathways for solutions to be contributed from funded organizations throughout the network.

The implementation of the SN Sub-Element is divided into the six projects listed below

- Knowledge Management
- Earth-Sun System Science e-Government Solutions
- Pre-Evaluation Studies
- Congressional Mandates Administration
- REASoN Solicitation Administration
- Decision Solicitation Administration – Performance Networks

a. Knowledge Management

This activity focuses on establishing, evolving, and maintaining NASA's Earth-Sun System Division Research Project, System Components and Knowledge Bases. The Research Project Knowledge Base serves Program and project Managers in network analysis, optimization, and maintenance. Value accrues from enhanced decision-making, enhanced program/project effectiveness, reduced uncertainty, and optimization of research and development efforts. The Systems Components Knowledge Base systematically catalogues the NASA Earth-Sun system observation missions, sensors, models, data products, model products, and related systems capacities for consideration in NASA Applied Sciences Program projects. Collectively, the Knowledge Bases provide the ability to perform an evaluation, a preliminary assessment, of NASA capabilities with the potential to contribute input information to specific decision support tools identified by and with partner organizations. This capability directly supports the Systems Engineering Project Element/resource.

To build capacity in the use of NASA observations and model predictions, activities within this project element also include:

- Providing a standardized library for Earth-Sun system science applications databases, models, and algorithms. This NASA Earth-Sun System Science Components Library enables adoption of NASA Earth-Sun system models for use in partner decision support systems or decision support tools
- Supplying a Network Diagram to communicate the network of funded organizations associated with the Earth-Sun System Division
- Building capacity of systems engineering expertise and leadership

b. Earth-Sun System Science e-Government Solutions
The purpose of this activity is to design, develop, host, and maintain websites for Earth-Sun system science community programs. This includes hardware, software, and labor. This project element is responsible for the following web sites:

- CCTP Measurement and Monitoring Working Group
- GEO
- IWGEO
- Earth-Sun System Division System component web pages
- Earth-Sun System Science (ESSS) Network
- ESSS Applications - with an Interactive map and Landsat Mosaic Data
- ESSS - Internet
- ESSS - Sharepoint
- Global Positioning System (GPS) Applications Exchange
- Earth-Sun System Science Application Successes

The development and maintenance of these websites are critical methods for conveying information to the community-of-practice.

c. Pre-Evaluation Studies
There are Applied Sciences Program activities in the formative stages of the systems engineering process. These activities do not meet the criteria for inclusion as a National Application, but do hold promise of potentially being significant applications elements. These activities currently include research in the following: Surface Transportation, the Sun-Solar System, and Community Growth.

One example is the pre-evaluation activities under Surface Transportation. The Federal Highway Administration's (FHWA) Office of Transportation Operations is sponsoring a multi-year, multiphase initiative to develop requirements for a surface transportation weather decision support system to help the managers of winter road maintenance. The Maintenance Decision Support System (MDSS), a prototype decision support system aimed at winter-weather road operations, is being developed for the FHWA by a team of national research centers. The primary goal of MDSS is to enable proactive decision-making for transportation systems operations before and during adverse weather conditions. The impacts of MDSS implementation include reduced operating expenses and greater road treatment service resulting in safer operation for all highway users.

While NASA is recognized in the Needs Assessment Report as a potential data contributor to weather information for surface transportation, the collaborative relationships between the transportation entities, federal or non-federal, and NASA have not yet been formalized. The transportation community has recognized a strategic thrust to identify and address gaps in weather information, seeking technological solutions as

befitting the information requirements. The current focus is on establishing working relationships with MDSS developers and stakeholders. This formulation phase focuses on the evaluation of data requirements, modeling capacity, and performance parameters associated with MDSS, through which NASA conducts the evaluation process to match Earth-Sun System Division observations and predictions to MDSS modeling and performance requirements. At the conclusion of this pre-formulation phase, it is anticipated that longer-term collaborations will be implemented and an evaluation of the data assimilation capacity of MDSS will proceed, followed by verification, validation, and benchmarking in support of the National Applications Program Elements.

d. Congressional Mandates Administration

The Program Element does not plan to have any specific Congressional Mandates from year to year, but does anticipate based on historical information that there will be some administration required for projects to be undertaken at the direction of Congress. All Crosscutting Solutions Program Element proposals, including Congressionally Mandated must be peer reviewed and, if necessary, iterated with the recipients until determined to be suitable for funding. Proposals determined suitable for funding means proposals must be aligned to NASA's mission, have technical merit, and be cost reasonable. The administering field center (SSC for FY05) will provide the appropriate services for procurement, coordination, tracking and funding for the Program Element.

The draft list of projected FY05 Congressional Mandates that may be assigned to the Applied Sciences Program is given below.

Table 2: Potential congressional mandates for Applied Sciences Program FY05

Name	Draft Assignments for FY 2005 Congressional Mandates (1/10/05)	FY05 Likely UPN	Pre-Recission Total ($K)
Applications	Earth Science Applications Program. $15M above the President's request for FY05 for NASA Earth Science Applications Program for competitively-selected applications projects. Integrated results of NASA's Earth observing systems and Earth system models into decision support tools to serve Applications of National Priority: Homeland Security, Coastal Management, Agricultural Efficiency, Water Management and Disaster Management	895	$ 15,000
Desert Research Institute	Hyper spectral remote sensing research and development at the Desert Research Institute	895	$ 500
Pearl River Community College	Pearl River Community College in Mississippi for remote sensing, geographic information system and GPS training	895	$ 390
RACNE	Regional Application Center for the Northeast - Cayuga Community College in New York	895	$ 3,000
RIT	Integrated Sensing Systems at the Rochester Institute of Technology	895	$ 1,500
SUNY	Continuation of emerging research to apply remote sensing technology to forest management at State University of New York, College of Environmental Sciences and Forestry	895	$ 500
University of Alaska	University of Alaska for weather and ocean research	895	$ 3,000
University of North Dakota	University of North Dakota in Grand Forks for the Northern Great Plains Space Sciences and Technology Center	895	$ 2,000
University of Northern Iowa	University of Northern Iowa for the GeoTREE project	895	$ 750
University of Texas	University of Texas Mid-American Geospatial Information Center at the UT Center for Space Research in Austin, Texas to continue information collection through satellite imaging	895	$ 1,000
Utah State University	Utah State University in Logan, Utah for the Intermountain region Digital Image Archive and Processing Center	895	$ 1,000
University of Connecticut CLEAR	University of Connecticut for the Center for Land Use and Education Research (CLEAR)	895	$ 750
Number of Earmarks =	12	Total =	$ 29,390
Synergy (Managed Under Data Systems with a Portion Managed by Applied Sciences)	Synergy, including $1.5M for Battelle Pacific Northwest Laboratory's Infomart; not more than $1.5 to support the transition of Synergy Infomart activities to the ESE Application Division; and $12M through for extension of Synergy Data Pools (Applied Scien	752	$ 3,000

e. REASoN Solicitation Administration

The REASoN solicitation provides a distributed network of observations and information providers for Earth-Sun System science, applications and education. REASoN projects resulted from competitive sourcing solicitation concluded in FY03. The outcome of this competitive solicitation is fourteen applied sciences projects within a portfolio of forty-one projects. The objective of the REASoN program is to fund proposals to bring together the Earth-Sun System observations, science model predictions, and decision support tools to benchmark integrated solutions to serve society.

In pursuit of its objectives in Earth-Sun System science research, applications, and education, NASA is generating Earth-Sun System observations of unprecedented quality

and quantity and developing data processing and modeling capabilities to transform these data into products, information, and, ultimately, new knowledge of our planet and the solar environment. This FY03 Cooperative Agreement Notice (CAN) openly solicited proposals from industry, academia, and government that provide solutions for utilization of NASA assets and capabilities. These solutions support science findings and applications directed toward understanding and predicting the future of the Earth-Sun System, developing policy and resource management decision support systems, and creating educational tools to inspire and train current and future generations of scientists.

The projects funded under this CAN join on-going NASA observations and information projects to form the NASA Earth-Sun System science REASoN Network. The research, applications and education elements of the NASA Earth-Sun System science community share interests and requirements that can best be met through cooperative efforts that generate access and distribute data, information and knowledge. These projects will unite previously disparate activities and programs under a unified management approach, taking full advantage of public and private resources and partnerships to derive maximum benefit for the public good, and are consistent with the President's initiative on competitive sourcing.

The Applied Sciences REASoN Projects are found in Table 3.

Table 3: Applied Sciences Program REASoN Projects

REASoN Project Title	Performing Organization	PI	Managing Organization	Study Manager
NASA Wildfire Response R&D, Applications and Technology Implementation	Ames Research Center	Ambrosia	Code YO	Ambrose
A Geospatial Extension of the NASA Information Power Grid	Sinte Gleska University	Bordeaux	Code YO	Andersen
Application of ESE Data and Tools to Particulate Air Quality Management	Washington University	Falke	LaRC	Friedl (YO)
An Agent-based Interface to Terrestrial Ecological Forecasting	Ames Research Center	Golden	Code YS/YO	Turner
Delineating Ecological Sytems and Advancing Decision Support Tools for Land Use Planning	NatureServe	Grossman	Code YS/YO	Turner
Development of Remote Sensing-Assisted Natural and Technological Hazards Decision Support Systems	University of South Carolina	Jensen	Stennis	Graham
Integrating NASA Earth Sciences Enterprise Data into Global Agricultural Decision Support Systems	Goddard Space Flight Center	Kempler	Code YO	Sheffner
Taking GIS and Remote Sensing to the People of Kentucky: Developing an Open GIS Data Viewing and Distribution System for Kentucky	Governor's Office of Techn. of Geographic Information	Lambert	Stennis	Graham
Sensor to User; Applying MODIS to Coastal Zone Management and K-12 Educational Outreach	Applied Coherent Technology Corp	Malaret	Stennis	Hall
Converging NASA Mission Measurements and Products with the Rapid Syndrome Validation Program (RSVP) Decision Support System to Validate and Benchmark Public Health Medical Alerts and Early Warning Systems	University of New Mexico	Morain	Stennis	Vann
The Invasive Species Data Service: Towards Operational Use of ESE Data in the USGS Invasive Species Decision Support System	Goddard Space Flight Center	Schnase	Code YO	Sheffner
A Regional Monitoring and Visualization System for the Mesoamerican Biological Corridor and Beyond	Marshall Space Flight Center	Sever	Code YS/YO	Turner
A Border Security Decision Support System Driven by Remotely Sensed Data Inputs	San Diego State University	Stow	Stennis	Davis
The Global Land Cover Facility	University of Maryland College Park	Townshend	Code YO	Sheffner
Systems Integration and Visualization of Yellowstone: an Earth Systems Research, Application, and Education Solution	Foundation of California State University Monterey Bay	Watson	Stennis	McKellip

f. Decision Solicitation Administration – Solutions Networks

The SN team at NASA SSC, in coordination with the Applied Sciences Program management, will manage the administration of projects selected under this solicitation.

The Solutions Networks component of the "Decision Support Through Earth Science Results" NRA focuses on improving the collective ability of Earth-Sun system science organizations to interact and harness the results of Earth-Sun system science research. Successful projects will characterize the existing organizational networks, add

organizations and develop new connections, and mine the Earth-Sun system science results that may address some or all of the twelve Applications of National Priority. A document listing representative members of the community-of-practice for NASA Earth-Sun system science is accessible at webserv.gsfc.nasa.gov/images/aiwg.html.

3. Geoscience Standards and Interoperability Sub-Element

NASA has responsibilities and commitments to facilitate development of, and comply with, national and international standards and interoperability protocols for the exchange of data and information produced by federal agencies. The GSI Sub-Element focuses on serving NASA commitments to the FGDC, GOS, the President's Management Agenda, and e-Government initiatives.

Standards for data storage, distribution formats and distribution mechanisms are essential to enable broad use of Earth-Sun System science observations for societal benefit. This Sub-Element emphasizes full and open access to data, applications of data, and enabling technologies that contribute to furthering the interoperability of disparate Earth-Sun system observation sources, data products, data handling systems, and model outputs – all as inputs to decision support systems that are the targets of integrated system solutions.

NASA is a strategic member in the OGC and the International Standards Organization (ISO) committee working on ISO/TC211, a geographic information series of standards. These contributions are crucial to the focus and development of geospatial interoperability standards being universally adopted. The Sub-Element assesses areas within the Applied Sciences Program and NASA along with other federal, state, and local agencies in which interoperability is necessary; begins communications; and develops strategies to educate, develop, and implement geoscience data interoperability. The development and implementation process is accomplished through memberships, partnerships, and participation in groups and organizations that are working towards similar interoperability goals. Some examples include:

- Participating in the President's Management Agenda e-Government Initiative
- Providing leadership to Geospatial One Stop and leading one of the GOS modules
- Representing NASA on the FGDC Coordination Working Group
- Chairing FGDC's Geospatial Applications and Interoperability Working Group (GAI)
- Representing NASA in the OGC and ISO TC211
- Participating in Research and Development efforts
- Representing NASA's interests in the OGC Consortium of which NASA is a strategic member

a. Geospatial Interoperability Office (GIO)

The Geoscience Standards and Interoperability Sub-Element is primarily implemented through the GIO located at Goddard Space Flight Center. Specific activity areas include:

- Earth-Sun Gateway (ESG) prototype development and benchmarking
- Interoperability support to National Applications
- Geospatial Standards Leadership
- Geospatial One Stop (GOS)
- Standards Development and Implementation

4. Human Capital Development Sub-Element

This strategic Sub-Element is chartered with the responsibility to:

- Develop a cadre of human resources possessing real world experience associated with integrated system solutions using results from NASA Earth-Sun systems science research, systems engineering, and partner agency decision support tools.
- Create rapid prototype solutions using Earth-Sun system science research results as inputs to decision support systems for state, local, and tribal applications consistent with the identified Applications of National Priority.
- Expand the network of organizations and individuals benefiting from, and contributing to, the Applied Sciences Program.

a. DEVELOP

The HCD Sub-Element is primarily accomplished through DEVELOP—a student-based applications and outreach program. Students from high schools and universities throughout the country employ network and systems approaches in a structured project environment to research issues of community concern based on requests from state, local, and tribal governments. Students are sponsored to develop prototype solutions based on Earth-Sun system science results including space-based observations, science models, and enhanced decision support systems. The results are demonstrated at high-level regional and national forums such as Governor's conferences, showcasing the utility of Earth-Sun system science knowledge. DEVELOP fills a niche for rapidly prototyping solutions for local applications with the benefit of developing intellectual capital for extending capacity to be adopted or adapted for national, regional, or international applications.

DEVELOP is a leveraged project with partnering support from industry, federal agencies, and non-profit institutions and state-based organizations.

The DEVELOP National Program Office is located at Langley Research Center.

B. Previously Funded Activities To Be Completed in FY05

1. IBS Sub-Element Activity

Scientific Data Purchase (SDP) Transition to EOSDIS

SDP was a demonstration program developed in response to administration direction, whereby NASA purchased remote sensing observations from the private sector. Initiated in FY97, the SDP was funded to provide scientific observations to the Earth-Sun System Division science community. The $70 million program was an opportunity to advance global systems research, to strengthen the U.S. economy through development of remote sensing technologies, and to test a new way of doing business.

The SDP program was concluded in FY03. NASA continued to operate the SDP data archive through FY04 in order to provide NASA researchers access to SDP commercial data supporting on-going Earth-Sun system science research. In FY05, NASA is transitioning the SDP data into a format compliant with the Earth observing system Clearing HOuse (ECHO) systems used in NASA DAACs. Accomplishing this task will allow maximum benefit of NASA procured data into the science community through the extended DAAC user network. The purpose of ECHO is

to convert all existing SDP commercial data into an ECHO compliant format that can be linked into the DAAC network.

2. SN Sub-Element Activities

Affiliated Research Centers (ARCs)
The ARCs program funds competitively selected university partners to develop the capacity to use results of Earth-Sun System Division research and development of aerospace science and technology. Working in partnership with university research teams provides partners access to the most advanced facilities and most capable research scientists in the nation. At the same time, students and university staff are exposed to industry requirements and real-world problem-solving situations through partnerships. This learning laboratory approach allows partners to use existing NASA and university resources to investigate opportunities for decision support without making large investments in unproven areas. Ultimately, the ARC program helps to establish and extend the limits of remote sensing applications while training tomorrow's work force.

Integrated Solutions for Community Growth through State/Local/Tribal (SLT) Partnerships (Broad Agency Announcements (BAAs))
This project focuses on extending the results of Earth-Sun system science investments, in the form of observations and expertise, to benefit government and economy by improving decision-making and policy formulation in the operations of state, local, regional, and tribal governments. Fifteen state, local, tribal, and regional government partnerships with NASA were competitively awarded under BAA-01-OES-01 in 2001 and funding was completed in FY04. The projects will be completed and results presented in FY05. Administration of these projects is targeted to:

- Extend the benefits of NASA-derived observations, research, and technology from global and national levels to state, local, regional and tribal levels
- Support development of a robust remote sensing community involving public and private sector partners
- Transfer remote sensing and associated technologies to user communities with the prime responsibility for resource management and related activities requiring geospatial information

FY04 Congressional Mandates and Legacy Projects

All Crosscutting Solutions Program Element proposals must be peer reviewed and, if necessary, iterated with the recipients until determined to be suitable for funding. Proposals determined suitable for funding means proposals must be aligned to NASA's mission, have merit, and be cost reasonable. The following describes the NASA Applied Sciences Program FY04 congressional mandates to be managed in FY05.

Crosscutting Solutions FY04 Congressional Mandates Performed in FY05
Center for Southeastern Tropical Remote Sensing (CSTARS)
The Disaster Management Program Element manages the CSTARS congressional mandate at the University of Miami.
State University of New York (SUNY)
The Carbon Management Program Element manages the SUNY congressional mandate. The SUNY project pursues applying remote sensing technologies to forest management.
Regional Applications Center for the Northeast (RACNE)
The Geospatial Interoperability Office, through the GSI Sub-Element, manages the RACNE congressional mandate.

George Mason University
The George Mason University Center for Mid-Atlantic Geospatial Information Consortium is managed under the Public Health Program Element.
Fulton Montgomery Community College
The Human Capital Development Sub-Element manages the Fulton Montgomery Community College Spatial Information Technology Center congressional mandate.
State of Alaska
The State of Alaska, Department of Military and Veterans Affairs – Alaska Aviation Safety Program is managed under the Disaster Management Program Element.
Rochester Institute of Technology
The Disaster Management Program Element manages the RIT Integrated Sensing Systems Congressional mandate.
Utah State University
The Utah State University activities for landscape analysis, planning and monitoring at the Intermountain Region Digital Image Archive and Processing Center are managed under the Invasive Species Program Element.
University of New Mexico
The University of New Mexico Center for Rapid Environmental Assessment and Terrain Evaluation is managed by the Integrated Benchmarked Systems function of the Crosscutting Solutions Program Element.
Upper Midwest Aerospace Consortium (UMAC)
The Agricultural Efficiency Program Element manages the UMAC congressional mandate. The UMAC congressional mandate supports Earth science education and remote sensing activities at the University of North Dakota.

FY04 Earmarks Funded through other Organizations and Managed in Crosscutting Solutions
Applications Portion of Synergy V
Synergy V is a mandate managed by the Data Systems Organization in the Science Mission Directorate. There are two distinct areas of focus under the mandate. The first is the evolution of Earth Science Data Systems. The second is aligned with the Applied Sciences Program and focuses on using open data standards to facilitate the efficient execution of integrated system solutions for National Applications and Education activities. The Geospatial Interoperability Office, through the GSI Sub-Element, manages this activity.
Center for Land use Education and Research (CLEAR)
The Human Capital Development Sub-Element manages the CLEAR congressional mandate at the University of Connecticut for the Education Organization at NASA Headquarters.

Legacy Projects in Crosscutting Solutions
The following describes the NASA Applied Sciences Program FY04 Legacy Projects conducted under challenge grants to be managed in FY05. While technically not congressional mandates, the administration of these grants is identical. Like all other funded activities under the Applied Sciences Program, the projects plans for Legacy Projects must be aligned to NASA's mission, have technical merit, and be cost reasonable.
University of Mississippi Enterprise for Innovative Geospatial Solutions (EIGS)
The EIGS is a cluster of six programs and thirty-five companies working to further develop the geospatial industry in Mississippi.
University of Mississippi Institute for the Advancement of Geospatial Systems (IAEGS)
IAEGS will provide diversified workforce in the field of remote sensing.
Mississippi State University Geospatial and Natural Resources Institute (GNRI)
One of the primary goals of GNRI is to produce research and educational processes that deliver robust decision support systems using geospatial technologies to solve problems encountered by stakeholders.
Institute for Technology Development (ITD)
ITD conducts applied research and converts results into marketable products or services.

V. Schedules, Milestones and Performance Measures

Schedule and Milestones

Table 4: FY05 IBPD Metrics and the Crosscutting Solutions Program Element

FY05 IBPD Metric										
Sub-Elements	5ESA1	5ESA2	5ESA3	5ESA4	5ESA5	5ESA6	5ESA7	5ESA8	5ESA9	5ESA10
Integrated Benchmark Systems	Sept. 2005	Sept. 2005		Sept. 2005		Sept. 2005	Sept. 2005	Sept. 2005	Sept. 2005	Sept. 2005
Solutions Networks		Sept. 2005		Sept. 2005		Sept. 2005	Sept. 2005	Sept. 2005	Sept. 2005	Sept. 2005
Geoscience Standards and Interoperability		Sept. 2005				Sept. 2005	Sept. 2005		Sept. 2005	Sept. 2005
Human Capital Development			Sept. 2005		Sept. 2005					

* For detailed information on IBPD metrics, see http://aiwg.gsfc.nasa.gov

Performance Measures

The Sub-Element plans and projects specify milestones, metrics and deliverables for each task or work package. The Program measures Sub-Elements relative to the milestones and deliverables established. Each project within also identifies the Division-level IBPD documented deliverables that are supported by the work conducted within the Element.

The Program Manager works with the Earth-Sun System Division in developing the IBPD materials, and ensuring that the IBPD deliverables are in line with the objectives of the Program Elements. The IBPD Annual Performance Goals relevant to the Crosscutting Solutions Program are listed in Table 5 below (the Applications Theme IBPD can be found at http://aiwg.gsfc.nasa.gov/. In addition to those listed in the table, goals pertaining to competitive sourcing and resource management also apply.

Table 5: IBPD Annual Performance Goals Relevant to the Crosscutting Solutions Program

FY05 IBPD Metric										
Sub-Elements	5ESA1	5ESA2	5ESA3	5ESA4	5ESA5	5ESA6	5ESA7	5ESA8	5ESA9	5ESA10
Integrated Benchmark Systems	Lead	Assist		Assist		Assist	Assist	Assist	Assist	Assist
Solutions Networks		Assist		Lead		Assist	Assist	Lead	Assist	Assist
Geoscience Standards and Interoperability		Assist				Assist	Assist		Assist	Assist
Human Capital Development			Lead		Lead					

Appendix A: Applied Sciences Program Budgets FY05-09

The Program Budget and Crosscutting Solution Planned Allocations are presented in Tables 4, 5 and 6.

Table 6: FY05 Applied Sciences Budget Breakdown (in $K)

DESCRIPTION	FY05 $K
Applications Theme Budget	$ 76,900
Education and Outreach Portion of Theme	*$ 23,100*
Applied Sciences Portion of Theme	*$ 53,800*
Total Applied Sciences Portion of Theme	$ 53,800
Fixed Institutional Costs	*$ 32,074*
National Applications Procurement Allocation	*$ 7,648*
Crosscutting Solutions Procurement Allocation	*$ 14,078*

Table 7: Crosscutting Solutions FY05 Budget Allocations

DESCRIPTION	FY05 $K
Crosscutting Solutions Procurement Allocation	$ 14,078
Integrated Benchmarked Systems Allocation	*$ 3,528*
Solutions Networks Allocation	*$ 8,150*
Geoscience Standards and Interoperability Allocation	*$ 2,000*
Human Capital Development Allocation	*$ 400*

Table 8: Crosscutting Solutions Budget FY05-09 (Full-Cost, based on the President's Budget - Process 340, January 25, 2005)

	FY05 ($K)	FY06 ($K)	FY07 ($K)	FY08 ($K)	FY09 ($K)
Crosscutting Solutions	31,571	33,212	32,562	32,528	30,018

Appendix B: Acronyms and Websites

Acronyms:

AGU	American Geophysical Union
AIWG	Applications Interagency Working Group
AMS	American Meteorological Society
ARC	Ames Research Center
ARCs	Affiliated Research Center
BAA	Broad Agency Announcement
CAN	Cooperative Agreement Notice
CCSP	Climate Change Science Program
CCTP	Climate Change Technology Program
CENR	Committee on Environment and Natural Resources
CENR/SDR	CENR Subcommittee on Disaster Reduction
CEOS	Committee on Earth Observing States
CLEAR	Center for Land Use and Education Research
CRSP	Commercial Remote Sensing Policy
CRSSP	Commercial Remote Sensing Space Policy
CSTARS	Center for Southeastern Tropical Remote Sensing
DAAC	Distributed Active Archive Center
DFRC	Dryden Flight Research Center
DSS	Decision Support System
DST	Decision Support Tool
ECHO	Earth observing system Clearing HOuse
EIGS	Enterprise for Innovative Geospatial Solutions
EOSDIS	Earth Observing System Data Information System
ESG	Earth-Sun Gateway
ESIP	Earth Science Information Partnership
ESMF	Earth Science Model Framework
ESSS	Earth-Sun System science
FEA	Federal Enterprise Architecture
FGDC	Federal Geographic Data Committee
FHWA	Federal Highway Administration
FY	Fiscal Year
GAI	Geospatial Applications and Interoperability
GCOS	Global Climate Observing System
GEO	*ad hoc* Group on Earth Observations
GIG	Global Information Grid
GIO	Geospatial Interoperability Office
GNRI	Geospatial and Natural Resources Institute
GOOS	Global Ocean Observing System
GOS	Geospatial One Stop
GPS	Global Positioning System
GRID	Graphic Retrieval and Information Display
GSFC	Goddard Space Flight Center
GSI	Geoscience Standards and Interoperability
GTOS	Global Terrestrial Observing System
HCD	Human Capital Development
HQ	NASA Headquarters
IAEGS	Institute for the Advancement of Geospatial Systems
IBPD	Integrated Budget and Performance Document
IBS	Integrated Benchmarked Systems
IEEE	Institute of Electrical and Electronics Engineers
IGARSS	International Geosciences and Remote Sensing Symposium
IPCC	International Panel on Climate Change
IRSE	International Symposium on Remote Sensing of Environment
ISO	International Standards Organization
ISPRS	International Society of Photogrammetry and Remote Sensing
ISS	Integrated System Solutions
ITD	Institute for Technology Development
IV&V	Independent Verification and Validation
IWGEO	Interagency Working Group on Earth Observations
JACIE	Joint Agency Commercial Imagery Evaluation
JCSDA	Joint Center for Satellite Data Assimilation
JPL	Jet Propulsion Laboratory
LaRC	Langley Research Center
MDSS	Maintenance Decision Support System
MSFC	Marshall Space Flight Center
NAS	National Academy of Sciences
NASA	National Aeronautics and Space Administration
NGA	National Geospatial-Intelligence Agency
NRA	NASA Research Announcement
NSF	National Science Foundation
NSGIC	National States Geographic Information Council
OGC	OpenGIS Consortium
OMB	Office of Management and Budget
OSSE	Observing System Simulation Experiment
PART	Program Assessment Rating Tool
PEN	Program Engineering Notebook
PERS	Photogrammetric Engineering and Remote Sensing
RACNE	Regional Applications Center for the Northeast
REASoN	Research, Education, and Applications Solutions Network
R2O	Research to Operations
SDP	Scientific Data Purchase
SEA	State Enterprise Architecture
SESWG	Solid Earth Science Working Group
SLT	State, Local, Tribal governments
SN	Solutions Network
SSC	Stennis Space Center
SSMF	Sun-Solar System Modeling Framework
SUNY	State University of New York
UMAC	Upper Midwest Aerospace Consortium
USGS	United States Geological Survey
USWRP	United States Weather Research Program
V&V	Verification and Validation
WMO	World Meteorological Organization
WSSD	World Summit on Sustainable Development

Websites:

NASA Applications Roadmaps and ISS Diagrams:
http://www.earth.nasa.gov/roadmaps
NASA Applications Theme IBPD: http://aiwg.gsfc.nasa.gov
NASA Earth Science Applications Plan:
http://www.earth.nasa.gov/visions
Representative members of the community-of-practice for NASA Earth-Sun system science:
Webserv.gsfc.nasa.gov/images/aiwg.html

CCSP: http://www.climatescience.gov
CCTP: http://www.climatetechnology.gov
CENR Interagency Working Group on Earth Observations:
http://iwgeo.ssc.nasa.gov

CENR/SDR: http://www.sdr.gov
CRSSP: http://www.crsp.usgs.gov
GEO: http://earthobservations.org
IPCC: http://www.ipcc.int
National Academy of Sciences Roundtable for Sustainability:
http://www.nas.edu
President's Initative Against Illegal Logging:
http://www.whitehouse.gov/infocus/illegal-logging
U.S. Weather Research Program:
http://www.oar.noaa.gov/organization/uswrp.html
WMO: http://www.wmo.int
WSSD: http://www.iied.org/wssd